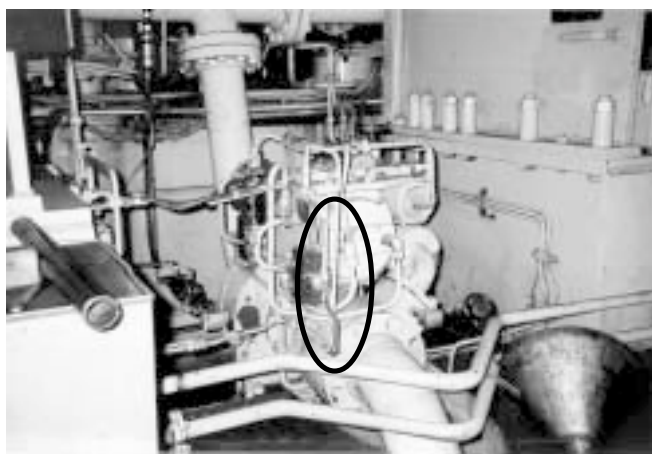


SAFETY ADVISORY BULLETIN 00-01

THE IMPORTANCE OF IDENTIFYING AND ADDRESSING ROOT CAUSES OF EQUIPMENT MALFUNCTIONS

A number of incidents have occurred in Washington waters that illustrate the importance of correctly identifying and properly addressing equipment problems.

- A bulk carrier grounded on the Columbia River, endangering a dredge working nearby. The ship's steering gear failed during a turn. Fortunately, the ship was not holed but was sufficiently hard aground to require tugs to refloat it. Inspection of the steering engine room revealed that efforts had been made to provide additional cooling to the steering gear. Investigation revealed that the steering gear had failed again during the refloating attempt, and that the ship had lost steering before while underway at another U.S. port. The company was urged to have a comprehensive examination of the steering gear system to address the heat and intermittent failure problems.



Main engine starting air valve that malfunctioned. Note modification indicated by the unpainted copper tubing (circled).

- A tanker loaded with gasoline grounded on the Columbia River. The rudder angle indicator showed that the rudder was not moving. Following the grounding it was found that the rudder angle indicator had been deprived of power, but the rudder was still operable. The loss of power to the rudder angle indicator resulted from a failure in the ship's emergency electrical circuit. Inspection found an overheated lead in the emergency circuit, and it was replaced. Two months later, while at sea, the ship experienced a similar failure of the emergency circuit. Further examination of the problem revealed that the addition of electrical load to the emergency circuit, without adequate review of the impact on the system, was at the root of the problem.
- A ferry nearly grounded in Puget Sound. The ship lost propulsion, steering, and power. The cause of the loss was the opening of an electrical breaker due to overheating under a normal load. Investigation found that repeated opening of the breaker under load had previously occurred and had pitted the breaker contacts, causing overheating. The cause of the breaker opening events

remained unidentified until the near-grounding, after which it was traced to an electrical component that was improperly set when installed some time before.

Each of these illustrates the need for ship operators to fully investigate equipment problems and to satisfy themselves that a root cause or causes (sometimes called basic or underlying causes) have been established.

Proper preventive maintenance is one of the foundations of the International Safety Management (ISM) Code. Section 9 of the ISM Code states "The SMS [Safety Management System] should include procedures ensuring that all non-conformities, accidents and hazardous situations

are reported to the Company, investigated and analyzed with the objective of improving safety and pollution prevention. The Company should establish procedures for the implementation of corrective action." [Emphasis added.] Company procedures should include follow-up to ensure that corrective action was effective.

Section 10 of the ISM Code requires essential systems, such as those in the cases discussed above, to be fully functional and operational. "The SMS should provide for specific measures aimed at promoting the reliability of such equipment or systems." Vessel operators using root cause analysis will be well positioned to fully comply with the ISM Code requirement.

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